CLAIMS

WHAT IS CLAIMED IS:

1. A method of forming nanomechanical structures comprising:

(a) providing a nanomechanical structural feature supported on a layer of sacrificial material and connected to a larger structural element;

(b) applying a film onto the structural feature by energy beam assisted deposit of material from a vapor through which the beam passes to cover at least a portion of the structural feature;

(c) applying a wet etchant to the structural feature covered by the film and to the sacrificial layer supporting the structural feature, the wet etchant selected to etch the sacrificial layer material preferentially as compared to the structural feature and to the film covering it to leave the structural feature supported by its connection to the larger structural element; and

(d) removing the covering film from the structural feature.

2. The method of Claim 1 wherein the vapor contains carbon and wherein the film deposited on the structural feature comprises a carbon film.

3. The method of Claim 2 wherein the carbon film is deposited to a thickness of at least 5 nm.

4. The method of Claim 2 wherein the energy beam is an electron beam that is scanned over the structural feature.

5. The method of Claim 2 wherein the carbon film is deposited to a thickness of 40 to 50 nm.

6. The method of Claim 2 wherein removing the covering film of carbon is carried out by oxygen plasma etching.

7. The method of Claim 2 wherein the structural feature is formed of silicon, the sacrificial layer is formed of silicon dioxide, and the wet etchant is buffered hydrofluoric acid.

8. The method of Claim 1 wherein the structural feature has a cross-sectional dimension that is 500 nm or less.

9. The method of Claim 1 wherein the energy beam is a scanning electron beam that is scanned over the structural feature.

10. The method of Claim 9 wherein the electron beam is provided by a scanning electron microscope.

11. The method of Claim 10 wherein the vapor is an organic vapor present in a sample chamber of the scanning electron microscope.

12. The method of Claim 9 wherein the electron beam is scanned over the structural feature and over an opening between the structural feature and adjacent structure to form a film extending over the opening between and connecting the structural feature and the adjacent structure.

13. A method of forming nanomechanical structures comprising:

(a) providing a nanomechanical structural feature having at least one cross-sectional dimension of 500 nm or less, supported on a layer of sacrificial material and connected to a larger structural element;

(b) applying a film of carbon onto the structural feature by scanning an electron beam over the structural feature to deposit material from a vapor containing carbon through which the beam passes to cover at least a portion of the structural feature;

(c) applying a wet etchant to the structural feature covered by the film and to the sacrificial layer supporting the structural feature, the wet etchant selected to etch the sacrificial layer material preferentially as compared to the structural feature and to the film covering it to leave the structural feature supported by its connection to the larger structural element; and

(d) removing the covering film from the structural feature by oxygen plasma etching.

14. The method of Claim 13 wherein the carbon film is deposited to a thickness of at least 5 nm.

15. The method of Claim 13 wherein the carbon film is deposited to a thickness of 40 to 50 nm.

16. The method of Claim 13 wherein the structural feature is formed of silicon, the sacrificial layer is formed of silicon dioxide, and the wet etchant is buffered hydrofluoric acid.

17. The method of Claim 13 wherein the structural feature has a cross-sectional dimension that is 100 nm or less.

18. The method of Claim 13 wherein the electron beam is provided by a scanning electron microscope.

19. The method of Claim 18 wherein the vapor is an organic vapor present in a sample chamber of the scanning electron microscope.

20. The method of Claim 13 wherein the electron beam is scanned over the structural feature and over an opening between the structural feature and adjacent structure to form a film extending over the opening between and connecting the structural feature and the adjacent structure.

21. A nanomechanical structure comprising:

(a) a nanomechanical structural feature having at least one cross-sectional dimension of 500 nm or less, the structural feature supported on a layer of sacrificial material and connected to a larger structural element and spaced by an opening from an adjacent structure; and

(b) a film of carbon material covering at least a portion of the structural feature and extending over the opening between and connecting the structural feature and the adjacent structure.

22. The nanomechanical structure of Claim 21 wherein the carbon film has a thickness of at least 5 nm.

23. The nanomechanical structure of Claim 21 wherein the carbon film has a thickness of 40 to 50 nm.

24. The nanomechanical structure of Claim 21 wherein the structural feature is formed of silicon and the sacrificial layer is formed of silicon dioxide.

25. The nanomechanical structure of Claim 21 wherein the structural feature has a cross-sectional dimension that is 100 nm or less.

26. A method of forming structural features on a semiconductor base comprising:

(a) providing a structural feature on a semiconductor base;

(b) applying a film of carbon onto the structural feature by scanning an electron beam over the structural feature to deposit material from a vapor containing carbon through which the beam passes to cover at least a portion of the structural feature;

(c) applying a wet etchant to the structural feature covered by the film and to the semiconductor base, the wet etchant selected to etch material of the semiconductor base preferentially as compared to the film covering the structural feature; and

(d) removing the covering carbon film from the structural feature.

27. The method of Claim 26 wherein removing the carbon film is carried out by oxygen plasma etching.

28. The method of Claim 26 wherein the carbon film is deposited to a thickness of at least 5 nm.

29. The method of Claim 26 wherein the carbon film is deposited to a thickness of 40 to 50 nm.

30. The method of Claim 26 wherein the structural feature is formed of silicon and the wet etchant is buffered hydrofluoric acid.

31. The method of Claim 26 wherein the structural feature has a cross-sectional dimension that is 500 nm or less.

32. The method of Claim 26 wherein the electron beam is provided by a scanning electron microscope.

33. The method of Claim 32 wherein the vapor is an organic vapor present in a sample chamber of the scanning electron microscope.

34. The method of Claim 26 wherein the electron beam is scanned over the structural feature and over an opening between the structural feature and adjacent structure to form a film extending over the opening between and connecting the structural feature and the adjacent structure.

35. A method of releasably holding structural features on a base comprising:

(a) providing a structural feature on a surface of a base;

(b) applying a film of carbon onto the structural feature by energy beam assisted deposit of material from a vapor containing carbon through which the beam passes to cover at least a portion of the structural feature and an adjoining portion of the surface of the base to hold the structural feature in place on the base; and

(c) removing the covering carbon film from the structural feature.

36. The method of Claim 35 wherein removing the carbon film is carried out by oxygen plasma etching.

37. The method of Claim 35 wherein the carbon film is deposited to a thickness of at least 5 nm.

38. The method of Claim 35 wherein the carbon film is deposited to a thickness of 40 to 50 nm.

39. The method of Claim 35 wherein the structural feature is not directly attached to the surface of the base and is free to move after the covering carbon film is removed from the structural feature.

40. The method of Claim 35 wherein the structural feature has a cross-sectional dimension that is 500 nm or less.

41. The method of Claim 35 wherein the energy beam is an electron beam that is scanned over the structural feature and the adjoining portion of the surface of the base.

42. The method of Claim 41 wherein the electron beam is provided by a scanning electron microscope.

43. The method of Claim 42 wherein the vapor is an organic vapor present in a sample chamber of the scanning electron microscope.

44. The method of Claim 41 wherein the electron beam is scanned over the structural feature and over an opening between the structural feature and adjacent structure to form a film extending over the opening between and connecting the structural feature and the adjacent structure.